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30)Priority

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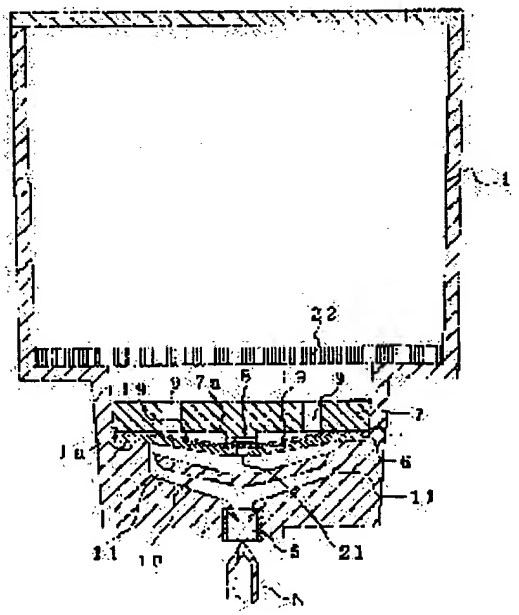
54) VALVE UNIT OF INK SUPPLY CHANNEL FOR INK JET RECORDER, INK CARTRIDGE EMPLOYING VALVE UNIT, INK SUPPLY NEEDLE AND MANUFACTURE OF VALVE UNIT

57)Abstract:

PROBLEM TO BE SOLVED: To remove a bubble surely from the vicinity of a diaphragm valve seat while sustaining a negative pressure suitable for a recording head by providing a plate for forming such a channel as the cross-sectional area decreases gradually from the upper end side of a diaphragm valve, i.e., the long extending side of an elastic supporting part.

SOLUTION: When ink in an ink cartridge is sucked by a negative pressure acting on a recording head under a state where the ink supply port 5 of the ink cartridge having an ink tank 1 is set in a recorder while being inserted with the ink supply needle N of a recording head, a diaphragm valve 6 is separated from a valve seat 8 and ink flows through a highest through hole 11 at the lower part of the diaphragm valve 6 into the ink supply port 5. Since a channel formed in the lower region of the diaphragm valve 6 is restricted in the breadthwise direction by a regulator 10 having V cross-section, bubbles below the diaphragm valve 6 are collected to the vicinity of the through hole 11. The bubbles are carried on an ink flow of relatively high



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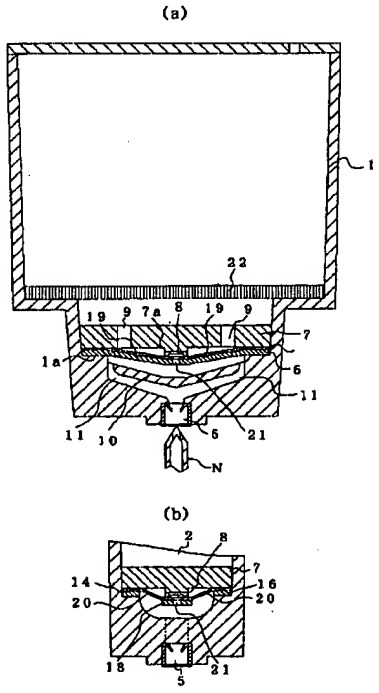
最終頁に続く

(54)【発明の名称】　インクジェット式記録装置のインク供給流路の弁装置、この弁装置を使用したインクカートリッジ、インク供給針、及び前記弁装置の製造方法

(57)【要約】

【課題】　メニスカスを維持できる負圧を記録ヘッドに与えつつ、記録ヘッドにインクを供給する弁装置の気泡を確実に排除すること。

【解決手段】　一端がインク室２に連通し、また他端がインクジェット式記録ヘッドに連通するインク供給流路の途中に、中心部に通孔２１を備え、インク室２とインクジェット式記録ヘッドとの圧力差に応動する弾性薄膜２０と弾性支持部１９とからなる膜弁６と、インク室側に位置して通孔に弾接する弁座８と、弁座８の下流側に配置され、弾性支持部１９の延長方向を長辺としてその端部側がインク室側を上方とし、かつ断面積が狭くなる流路を形成する流路形成板１０とを備える。



【特許請求の範囲】

【請求項１】　上流側と下流側との圧力差に応動する弾性薄膜、これの表面に形成され、通孔を有する弁体部、及び該弁体部と一体に形成されて常時上流側に付勢する弾性支持部とからなる膜弁と、
前記インク流路の上流側に位置して前記通孔に弾接する弁座と、
該弁座の下流側に配置され、前記弾性支持部の延長方向を長辺としてその端部側が上方となり、かつ断面積が狭くなる流路を形成する流路形成板とからなるインクジェット式記録装置のインク供給流路の弁装置。

【請求項２】　前記膜弁が、高分子フィルムと該高分子フィルムよりも弾性率の小さな板材の積層体として構成されている請求項１に記載のインクジェット式記録装置のインク供給流路の弁装置。

【請求項３】　前記弾性支持部が前記弁体部を両側から支持するように形成されている請求項１に記載のインクジェット式記録装置のインク供給流路の弁装置。

【請求項４】　前記弾性支持部が前記弁体部を片側から支持するように形成されている請求項１に記載のインクジェット式記録装置のインク供給流路の弁装置。

【請求項５】　前記弁体部から前記通孔を対称点とするように前記弾性支持部が放射状に整形されている請求項３に記載のインクジェット式記録装置のインク供給流路の弁装置。

【請求項６】　前記弾性薄膜が前記通孔を頂点とする凸型形状に塑性変形加工されている請求項１に記載のインクジェット式記録装置のインク供給流路の弁装置。

【請求項７】　前記凸型形状の脹らみが、少なくとも前記弁体部が前記弁座から離反する程度である請求項６に記載のインクジェット式記録装置のインク供給流路の弁装置。

【請求項８】　前記弾性薄膜が延伸性高分子である請求項６に記載のインクジェット式記録装置のインク供給流路の弁装置。

【請求項９】　前記弾性薄膜と前記弁体部との重複領域が接着されている請求項６に記載のインクジェット式記録装置のインク供給流路の弁装置。

【請求項１０】　上部にインク室を備えた、下部にインクジェット式記録ヘッドのインク供給針が挿入されるインク供給口を備えた容器と、
前記インク室と前記インク供給口とを分割するように張設され、上流側と下流側との圧力差に応動する弾性薄膜、これの表面に形成され、通孔を有する弁体部、及び該弁体部と一体に形成されて常時上流側に付勢する弾性支持部とからなる膜弁と、
前記インク流路の上流側に位置して前記通孔に弾接する弁座と、
該弁座の下流側に配置され、前記弾性支持部の延長方向を長辺としてその端部側が上方となり、かつ断面積が狭くなる流路を形成する流路形成板とからなるインクカートリッジ。

【請求項１１】　前記膜弁が、高分子フィルムと該高分子フィルムよりも弾性率の小さな板材の積層体として構成されている請求項１０に記載のインクカートリッジ。

【請求項１２】　前記弾性支持部が前記弁体部を両側から支持するように形成されている請求項１０に記載のインクカートリッジ。

【請求項１３】　前記弾性支持部が前記弁体部を片側から支持するように形成されている請求項１０に記載のインクカートリッジ。

【請求項１４】　前記弁体部から前記通孔を対称点とするように放射状に形成されている請求項１０に記載のインクカートリッジ。

【請求項１５】　前記弾性薄膜が、前記通孔を頂点とする凸型形状に塑性変形加工されている請求項１０に記載のインクカートリッジ。

【請求項１６】　前記凸型形状の脹らみが、少なくとも前記弁体部が前記弁座から離反する程度である請求項１５に記載のインクカートリッジ。

【請求項１７】　前記弾性薄膜が延伸性高分子である請求項１５に記載のインクカートリッジ。

【請求項１８】　前記弾性薄膜と前記弁体部との重複領域が接着されている請求項１５に記載のインクカートリッジ。

【請求項１９】　インクジェット式記録ヘッドのインク流路に連通して、インクカートリッジのインクを前記記録ヘッドに供給するインク供給針において、
前記インク供給針の上流側と下流側を分割するように張設され、上流側と下流側との圧力差に応動する弾性薄膜、これの表面に形成され、通孔を有する弁体部、及び該弁体部と一体に形成されて常時上流側に付勢する弾性支持部とからなる膜弁と、
前記インク流路の上流側に位置して前記通孔に弾接する弁座と、
からなるインク供給針。

【請求項２０】　該弁座の下流側に、前記弾性支持部の延長方向を長辺としてその端部側が上方となり、かつ断面積が狭くなる流路を形成する流路形成板が配置されている請求項１９に記載のインク供給針。

【請求項２１】　前記膜弁が、高分子フィルムと該高分子フィルムよりも弾性率の小さな板材の積層体として構成されている請求項１９に記載のインク供給針。

【請求項２２】　前記弾性支持部が前記弁体部を片側から支持するように形成されている請求項１９に記載のインク供給針。

【請求項２３】　前記弾性薄膜が、前記通孔を頂点とする凸型形状に塑性変形加工されている請求項１９に記載のインク供給針。

【請求項２４】　前記凸型形状の脹らみが、少なくとも

前記弁体部が前記弁座から離反する程度である請求項２３に記載のインク供給針。
【請求項２５】　前記弾性薄膜が延伸性高分子である請求項２３に記載のインク供給針。
【請求項２６】　前記弾性薄膜と前記弁体部との重複領域が接着されている請求項２３に記載のインク供給針。
【請求項２７】　弾性を有する板材に中心点に弁体部と、その中心に位置する通孔と、中心を点対称点とするように一端が前記弁体部に連続する弾性支持とを形成する工程と、
塑性変形可能な高分子材料のフィルムを中心に突出部を形成する工程と、
上記工程で構成された２部材を接合する工程とからなる弁装置の製造方法。
【請求項２８】　前記突出部が機械的に加圧されて形成されている請求項２７に記載の弁装置の製造方法。
【請求項２９】　前記突出部が流体的に加圧されれて形成されている請求項２７に記載の弁装置の製造方法。
【請求項３０】　前記突出部の突出量が、弁体部が弁座から少なくとも離反する程度である請求項２７に記載の弁装置の製造方法。
【請求項３１】　前記高分子フィルムが熱変形温度、または二次転移温度以上、軟化点よりも低い温度に加熱されている請求項２７に記載の弁装置の製造方法。
【発明の詳細な説明】
【０００１】
【発明が属する技術の分野】本発明は、インクジェット式記録ヘッドとインクタンクとを接続するインク供給流路に配置される負圧発生機能を備えた弁装置に関する。
【０００２】
【従来の技術】インクジェットプリンタは、共通のインク室とノズル開口とに連通する圧力発生室に圧力を印加してノズル開口からインク滴を吐出させるインクジェット式記録ヘッドと、記録ヘッドにインクを供給するインクカートリッジとをキャリッジに搭載し、キャリッジを往復動させながら印刷データに一致させてインク滴を記録用紙に吐出させるように構成されている。
【０００３】このような記録ヘッドは、通常そのノズル開口がインクカートリッジのインク液面よりも低くなるように配置されているため、ノズル開口には水頭圧が作用し、ノズル開口からインクの漏れ出しが生じるという問題がある。この問題を解消するため、通常インクカートリッジ内に多孔質体を収容し、多孔質体による毛細管力によりインクカートリッジのインクの圧力が記録ヘッドよりも若干低くなるように構成されている。
【０００４】しかしながら、インクの消費が進んで多孔質体に吸収されているインクの量が少なくなると、多孔質体の毛細管力に起因して記録ヘッドへのインクの供給に滞りが生じて、カートリッジ内のインクを完全に消費できないという問題や、多孔質体の実質体積分だけ、カートリッジに収容できるインクが少なくなってインクカートリッジが大型化する等の問題がある。
【０００５】このような問題を解決するため、例えば特開昭62-231759号公報に見られるようにインクタンクの下部に通孔を備えた壁によりインク溜めと空洞とに分離し、この通孔にアンブレラチェックバルブを設けて、記録ヘッドのインク圧が低下した時点で、バルブを開弁させてインク溜めのインクを空洞に排出させて記録ヘッドに供給するように構成したインクジェット記録ヘッド用のインクカートリッジが提案されている。
【０００６】これによれば、多孔質体が不要となるため、インクの収容量を増加させることが可能となるが、一般的にアンブレラチェックバルブは、記録ヘッドへのインクの供給を精密に調整するにはそのオフセット量が大き過ぎ、インク供給量や記録ヘッドとの差圧に大きな変動を来して印字品質の低下を招くという大きな問題がある。このような問題を解消するために、特開平8-174860号公報に見られるように、通孔を備えた弾性薄膜からなる膜弁座によりインク流入側とインク流出側とに分離し、インク流入側とインク流出側との間で若干でインクジェット式記録ヘッドのインク圧を負圧に維持させながら、記録ヘッドでのインク消費に合わせてインクを供給することができるインクカートリッジが提案されている。
【０００７】
【発明が解決しようとする課題】これによれば、広い面積の膜弁座により記録ヘッドでのインクの消費に対応させて記録ヘッドに負圧状態を維持させつつインクを供給することができるものの、インク滴吐出能力を回復させるために記録ヘッドに負圧を作用させて記録ヘッドからインクを強制的に排出させた際には、膜弁座の面積が大きいためここの流速が低く、気泡の排除が困難であるという不都合を抱えている。
【０００８】本発明はこのような問題に鑑みてなされたものであって、その目的とするところは、記録ヘッドとの間の微小な差圧に確実に応動して記録ヘッドに印字に適した負圧を維持させつつ、膜弁座近傍の気泡を確実に外部に排除することができるインクジェット式記録装置のインク供給路における弁装置を提供することである。本発明の第２の目的は、上記弁装置を内蔵したインクカートリッジ、及びインク供給針を提供することである。本発明の他の目的は、上記弁装置の製造方法を提案することである。
【０００９】
【課題を解決するための手段】このような問題を解消するために本発明においては、上流側と下流側との圧力差に応動する弾性薄膜、これの表面に形成され、通孔を有する弁体部、及び該弁体部と一体に形成されて常時上流側に付勢する弾性支持部とからなる膜弁と、前記インク流路の上流側に位置して前記通孔に弾接する弁座と、該

弁座の下流側に配置され、前記弾性支持部の延長方向を長辺としてその端部側が上方となり、かつ断面積が狭くなる流路を形成する流路形成板とを備えるようにした。

【００１０】

【作用】膜弁が広い面積で差圧を受けて記録ヘッドでのインクの消費に対応して流路を開いて記録ヘッドにインクを供給する。また流路形成板により膜弁の下部領域が端部側を上方としかつ狭くなるように形成されているため、ここに気泡が集中し、かつ記録ヘッドに負圧を作用させてインクを強制的に排出した際にもここのインク流速が無用に低下せず、したがって気泡がインク流に乗って外部に排出される。

【００１１】

【発明の実施の形態】そこで、以下に本発明の詳細を図示した実施例に基づいて説明する。図１は、本発明の弁装置が組み込まれたインクカートリッジの一実施例を示すものであって、インクカートリッジ本体を構成する容器１は、上部にインク室２を有し、また底面４に記録ヘッドのインク供給針Ｎが挿入されるインク供給口５を形成して構成されている。

【００１２】インク室２とインク供給口５との間には、これらを分離する膜弁６を収容できるように略矩形状の凹部が形成されている。膜弁６は、その下面の周囲を容器１の段差部１ａに支持されて、インク室側を弁座形成部材７により固定して容器１に組みこまれている。

【００１３】弁座形成部材７は、中心に下流側に突出する凸部７ａが形成され、その先端にゴムなどの弾性部材からなる弁座８が固定されて、また周辺にインク室２に連通する通孔９が少なくとも１つ、好ましくは凸部７ａを対称点とするように複数個穿設されている。

【００１４】膜弁６の下方領域には弁座８を最下部とし、また両側をインク室側とするインク流規制板１０が配置されている。インク流規制板１０が占める最高位置にはインク供給口５に連通する通孔１１、１１が穿設されている。

【００１５】膜弁座６は、図３（ａ）、（ｂ）に示したように柔軟な高分子フィルム１２と、金属板１３との積層体を長方形に切り出し、インク容器１と弁座形成部材７とによる支持領域となる４辺１４、１５、１６、１７と、弁体部１８となる中心部と、弁体部１８を両側から支持し、かつ長辺側に延びる細長い弾性支持部１９、１９を残すように金属板１３をエッチングして窓から高分子フィルム１２の露出部２０、２０を形成するとともに、弁体部１８にインクを流通させる通孔２１を穿設して構成されている。

【００１６】弾性支持部１９、１９は、記録ヘッドのメニスカスを維持できる程度の負圧よりも若干大きな差圧が作用したとき弾性変形できる弾性を有するように、その幅が選択されている。

【００１７】膜弁座６は、容器１の段差部１ａにセットされた状態で、インク室側から弁座形成部材７により固定して容器１に液密状態で固定され、必要に応じて上部にインクに含まれている気泡や、塵埃を除去するフィルタ２２が配置される。

【００１８】この実施例において、インクカートリッジのインク供給口５を、記録ヘッドのインク供給針Ｎに挿通して、記録装置にセットする。インク供給針Ｎの挿通により大気がインクカートリッジや記録ヘッドに浸入して以後の印刷に不都合を来す虞が有る。

【００１９】このような不都合を回避するため、記録ヘッドにキャップ部材を介して負圧を作用させてインクカートリッジのインクを記録ヘッドに吸い込むと、インク供給口５の圧力が低下して膜弁６に差圧が作用して、図２（ａ）、（ｂ）に示したように膜弁６が弁座８から離れてインク室２のインクが膜弁６の下部の最高位置の通孔１１を通過してインク供給口５に流れる。

【００２０】一方、膜弁６の下方領域はインク流路規制板１０により、膜弁６の長辺方向が端部程、膜弁側に接近し、かつ幅方向が絞られた流路が形成されているから、膜弁６の下方に集まっている気泡は自身の浮力により通孔１１の近傍に集まる。そしてここでのインクの流速は他の領域に比較して速いため、気泡はインク流に乗せられて記録ヘッドを経由してキャップ部材に排出される。

【００２１】インクの充填が終了した段階で、印刷を実行すると、膜弁座６の下部領域のインクがインク供給口５から記録ヘッドに流れ込み、膜弁６の下部領域の圧力が徐々に低下する。圧力低下が弾性支持部１９の支持力よりも大きくなると、膜弁６はインク供給口５側にたわんで通孔２１が弁座８から離れる。これによりインク供給口５の圧力が過度な負圧に至るまでにインク室２のインクが通孔２１を通ってインク供給口５に流れ込む。

【００２２】インクの流入により膜弁６の下部領域の圧力が若干上昇すると、弾性支持部１９は、上部からのインクの圧力に打ち勝って弁体部１８を、高分子フィルム１２の揺動等の影響を受けることなく、確実にガイドして上流側に移動させて弁座８に弾接させ、通孔２１を塞ぐ。これによりインク室２からのインクの流出が停止する。したがって、インク室３のインク液面の高低に関りなく、インク供給口５の圧力が記録ヘッドのメニスカスを維持するのに適した負圧に維持される。

【００２３】長時間の印刷によりノズル開口からのインク滴の吐出に不都合が生じた場合には、記録ヘッドのノズルプレートをキャッピング手段により封止して負圧を作用させると、前述のインクの充填操作時と同様の作用により、通孔１１の近傍に集まっている気泡が記録ヘッドの外に排出される。

【００２４】図４乃至図６は、それぞれ膜弁６の他の実施例を示すものであって、図４に示したものは、弁体部１８の通孔２１を点対称点とするように配置された枝部

２３、２３を、金属板１３のエッチング等により形成したもので、差圧を弁体部１８、及び弾性支持部１９に確実に伝達して高分子フィルム１２の過度な変形を防止することができる。

【００２５】図５は、膜弁６の下部領域の流路を、弾性支持部１９の延長方向の端部に行く程細くなるようにインク流路規制板１０で絞った場合に最適な膜弁の一実施例を示すもので、中心部の弁体部１８と、これを両側から支持する弾性支持部１９と、周辺に取付け用の枠部２５、２６、２７、２８を残すように、金属板１３をエッチングして菱形の窓を形成したものである。

【００２６】この実施例によれば、弁体部１８が位置する中央領域の高分子フィルム１２の剛性を弱めて、弁体部１８を差圧に容易に追従させることができる。また気泡が停滞しやすい最上部となる弾性支持部１９の固定部領域の流路を狭くできて、通孔９から流れ込んだインクの流れにより気泡を容易に排除することができる。

【００２７】図６は、弾性支持部１９、１９をジグザグ状に形成した弾性支持部１９’、１９’により弁体部１８を支持させたもので、この実施例によれば弾性支持部１９’、１９’のたわみ変形領域を拡大できて、微小な差圧に対しても弁体部２０を応動させることができる。

【００２８】図７（ａ）、（ｂ）は、本発明の他の実施例を示すものであって、膜弁６は図８に示したように弁体部１８の一側だけを弾性支持部２９により片持梁状に支持させるように構成されおり、また流路形成基板３０は、片持梁状の弾性支持部２９の延長方向に沿うように上方に傾斜し、幅が狭くなるように膜弁６の下部の流路を規制するとともに、その最高位置に設けた１つの通孔３１からインクをインク供給口５に流出させるように構成されている。

【００２９】この実施例によれば、膜弁６の近傍のインク流路の領域を可及的に狭く規制することが可能であるため、膜弁６の気泡を１箇所に集めてインク流れにより外部に排出することができる。

【００３０】図９は、同上弁装置に適した膜弁の一実施例を示すものであって、弁体部１８と、弾性支持部２９、枠部３２を残すように水滴型の窓３３を形成するように金属板をエッチング等により整形したものである。

【００３１】なお、上述の実施例においては弁装置をインクカートリッジに組み込んだ場合に例を採って説明したが、記録ヘッドとインクタンクを一体化したデスポーザブルタイプの記録ヘッドに対しては、図１０に示したように記録ヘッドのインク供給路Ｐとインクタンクとの接続領域に上述したの弁装置４０を組み込んでも同様の作用を奏することは明らかである。

【００３２】図１１（ａ）、（ｂ）は、それぞれ本発明の他の実施例を示すものであって、この実施例においては記録ヘッドＨに連通するインク供給路と、これに連通させて垂設されているインク供給針Ｎとの接続部に前述した弁装置４０を組み込んだもので、弁装置４０の下流側や、上流側にフィルタ４１、４２を設けたものである。

【００３３】なお、この実施例においては弁座部を両側から支持する場合に例を採って説明したが、図７に示した弁部を片持梁状に支持した弁装置を組み込むと、弾性支持部を短縮することができるため、組み込みが容易である。

【００３４】また、上述の実施例においては高分子フィルムと金属板との積層体をエッチングにより加工しているが、弁体部や弾性支持部、及び枠部を金属板のプレス加工により構成したり、また高分子の射出成形により構成した高分子板を高分子フィルムに貼着するようにしても同様の作用を奏する。

【００３５】ところで、比較的ドット密度が低い印刷データにあっては、膜弁に作用する差圧が低いため、膜弁全体の弾性を可及的に小さくするのが望ましが、弁体部の位置が不安定となりインク供給能力に低下を来して却って性能が低下する。

【００３６】図１２（ａ）は、このような問題を解消するのに適した膜弁の一実施例を示すものであって、弾性を有し、加工が容易な金属板、たとえば厚さ０．０３ｍｍ程度の不錆鋼５０を、中心点に弁体部５２と、その中心に位置する通孔５３と、中心を点対称点とするように一端が弁体部５２に連続するジグザグ状の枝部５４、５４と、枝部５４、５４の他端に接続する周縁部５５とをエッチング加工やプレス加工したものと、塑性変形可能な延伸性高分子材料、例えば厚さ０．００３５ｍｍのポリフェニレンサルファイド（ＰＰＳ）樹脂フィルム５１を図１２（ｂ）、（ｃ）に示したように弁体部５２が弁座８から少なくとも離反する程度まで中心部が突出するように予め塑性変形させたものとを望ましくは弁体部５２を接着層や粘着層を介して接合して構成されている。なお、接合後、または接合前に樹脂フィルム５１に対して弁体部５２の通孔５３に対応する位置に通孔を穿設して流路を形成する。

【００３７】このような塑性変形加工は、図１３（Ｉ）に示したように樹脂フィルム６０の熱変形温度、または二次転移温度以上、軟化点よりも低い温度に予め加熱して図１３（I）に示したように所望とする腹らみ形状の凸型材６１に位置決めし、ついで図１３（II）に示したように対応する凹型材６２により押圧することにより腹らみを付与することができる。

【００３８】この実施例によれば、樹脂フィルム５１は、開弁状態に相当する腹らみを付けられているので、弁体部５２の弁座８への当接力は、実質的に枝部５４、５４の弾性だけが作用することになる。この結果、枝部５４、５４の剛性を高めて弁体部５２のふらつきを防止しつつ、小さな差圧で開弁させることができる。

【００３９】そして、特に接合領域を樹脂フィルム５１

と弁体部５２とがラップする領域に限定すると、樹脂フィルム５１が弁体部５２に作用する弾性力を抑制できて、弁体部５２の追従性を高めることができる。

【００４０】図１４（ａ）、（ｂ）は、上述の塑性変形加工の他の実施例を示すもので、図１４（ａ）に示した実施例のおいては、塑性加工に必要な凹部６３が形成されたキャップ部材６４と、基台６５とにより樹脂フィルム６０の周縁を気密的に固定し、かつ熱変形温度、または二次転移温度以上、軟化点以下に加熱しつつ、凹部６３側の圧力が高くなるように通孔６６、６７差圧を付与、つまり凹部６３に負圧－Ｐを作用させたり、また基台側から圧力Ｐを加えたりして塑性変形させるものである。

【００４１】なお、上述の実施例においてはキャップ部材６４に塑性変形させるべき形状に対応した凹部６３を形成しているが、図１４（ｂ）に示したように単なる空洞６８として形成し、前述と同様に樹脂フィルム６０に差圧を付与しても同様に塑性変形をさせることができる。

【００４２】なお、このように高分子フィルムに塑性変形加工を施すことは、図３、図４、図５、図６、図８、図９に示した実施例に対しても有効であることは明らかである。

【００４３】

【発明の効果】以上、説明したように本発明においては、上流側と下流側との圧力差に応動する弾性薄膜、これの表面に形成され、通孔を有する弁体部、及び弁体部と一体に形成されて常時上流側に付勢する弾性支持部とからなる膜弁と、インク流路の上流側に位置して通孔に弾接する弁座と、弁座の下流側に配置され、弾性支持部の延長方向を長辺としてその端部側が上方となり、かつ断面積が狭くなる流路を形成する流路形成板と備えたので、膜弁が広い面積で差圧を受けて記録ヘッドでのインクの消費に対応して流路を開いて記録ヘッドにインクを供給でき、また流路形成板により膜弁の下部領域が端部側を上方としかつ狭くなるように形成されていて、ここに気泡を集中させ、かつ強制的に排出されるインクの流れに乗せて気泡を外部に確実に排出することができる。

【００４４】また薄膜単独で膜弁を構成する場合に比較して、弾性支持部材の剛性により、キャリッジ等の振動に関りなく膜弁の中心位置の保持と、インクによる弾性率の変動を防止して開閉動作を安定化して記録ヘッドへのインク供給の信頼性を確保することができる。

【図面の簡単な説明】

【図１】図（ａ）、（ｂ）は、それぞれ本発明のインクカートリッジの一実施例を、弁装置の長辺方向と短辺方向の断面構造を閉弁状態で示す図である。

【図２】図（ａ）、（ｂ）は、それぞれ本発明のインクカートリッジの一実施例を、弁装置の長辺方向と短辺方向の断面構造を開弁状態で示す図である。

【図３】図（ａ）、（ｂ）は、それぞれ同上弁装置を構成する膜弁の一実施例を示す上面図と、これに使用する板材の断面図である。

【図４】本発明のインクカートリッジに使用する膜弁の他の実施例を示す上面図である。

【図５】本発明のインクカートリッジに使用する膜弁の他の実施例を示す上面図である。

【図６】本発明のインクカートリッジに使用する膜弁の他の実施例を示す上面図である。

【図７】図（ａ）、（ｂ）は、本発明の弁装置の他の実施例を弁装置の長辺方向と短辺方向の断面構造を開弁状態で示す図である。

【図８】同上弁装置の膜弁の一実施例を示す上面図である。

【図９】同上弁装置の膜弁の他の実施例を示す上面図である。

【図１０】本発明の弁装置をインクタンクと一体構造として構成された記録ヘッドに組み込んだ実施例を示す断面図である。

【図１１】図（ａ）、（ｂ）は、それぞれ本発明の弁装置をインク供給針に組み込んだ実施例を示す断面図である。

【図１２】図（ａ）は、本発明に適した膜弁の他の実施例を示す上面図であり、また図（ｂ）、（ｃ）は、それぞれ膜弁を構成する樹脂フィルムの形状をＡ－Ａ線、Ｂ－Ｂ線での断面形状を示す図である。

【図１３】図（I）、（II）は、それぞれ同上膜弁の製造工程の内、樹脂フィルムの加工工程を示す図である。

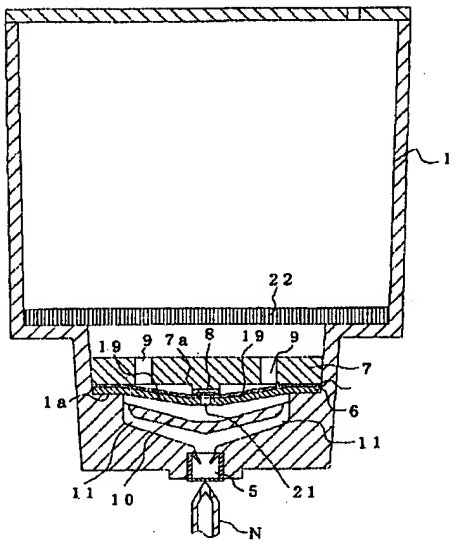
【図１４】図（ａ）、（ｂ）は、同上膜弁の製造方法の他の実施例を示す図である。

【符号の説明】

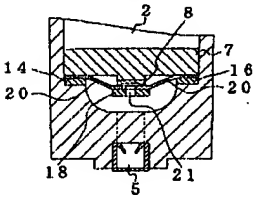
１　インク容器
２　インク室
５　インク供給口
６　膜弁
７　弁座形成部材
８　弁座
９　通孔
１２　高分子フィルム
１９　弾性支持部
２０　高分子フィルムの露出部
２１　通孔
Ｎ　インク供給針
Ｈ　インクジェット式記録ヘッド
Ｐ　インク流路

【図１】

(a)

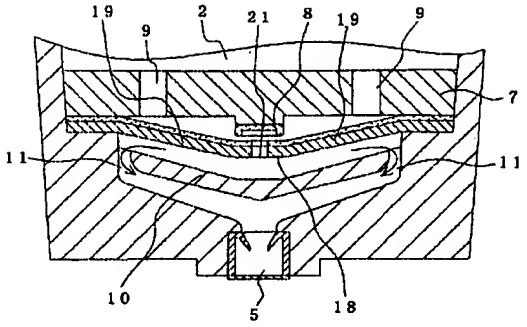


(b)

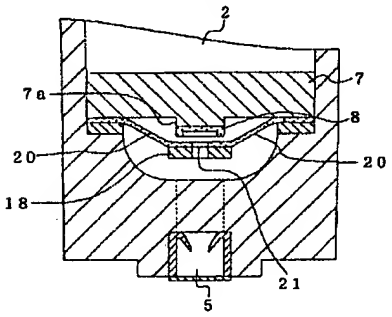


【図２】

(a)

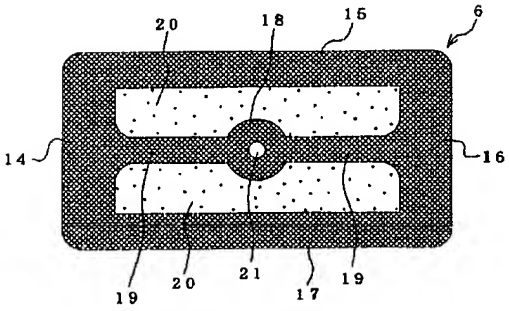


(b)

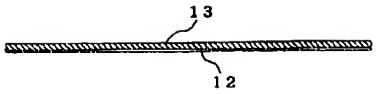


【図３】

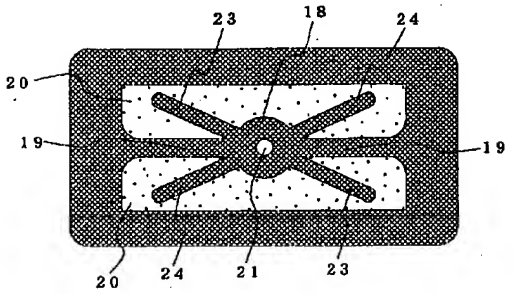
(a)



(b)



【図４】



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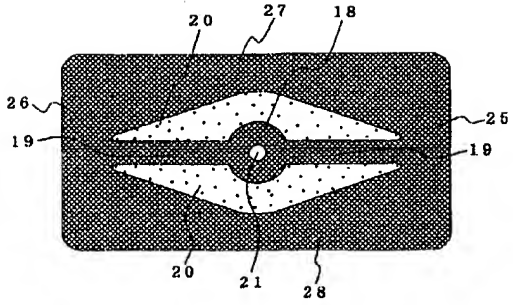

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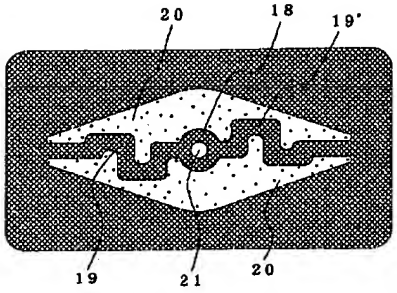

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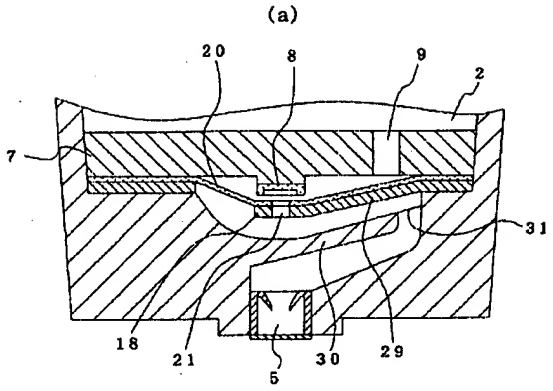

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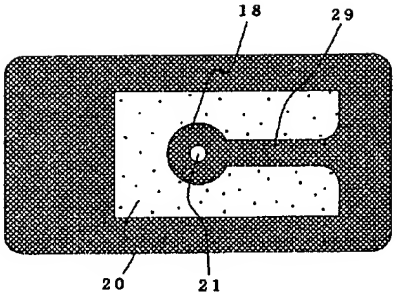

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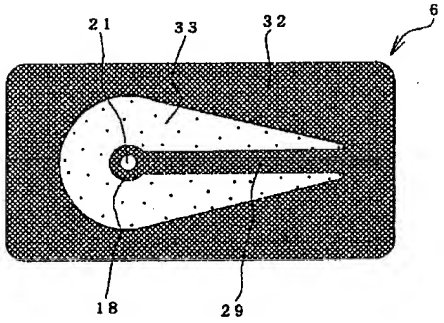

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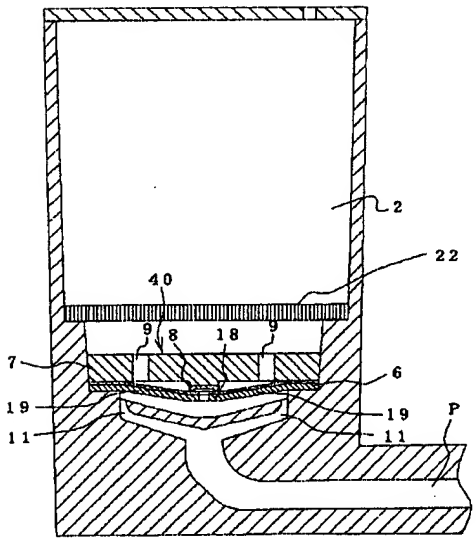

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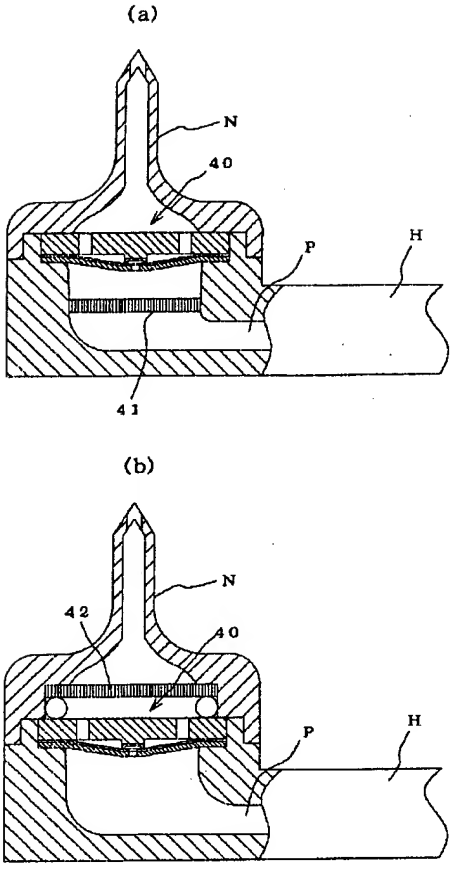

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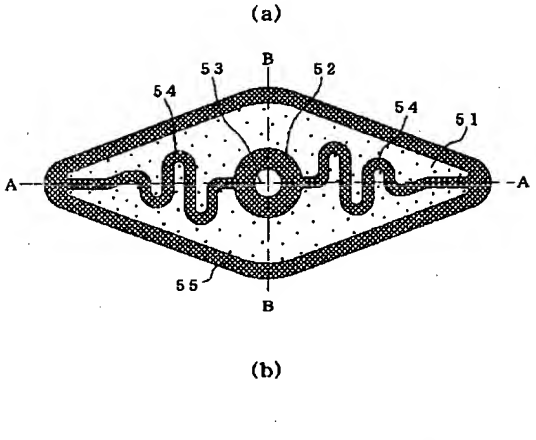

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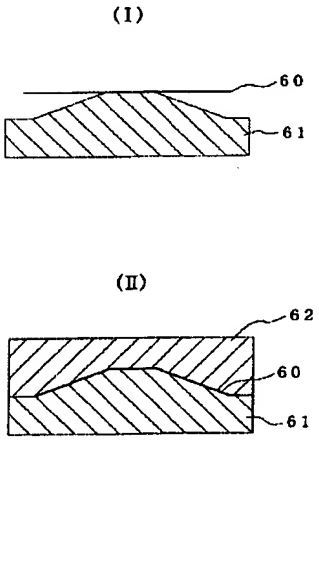

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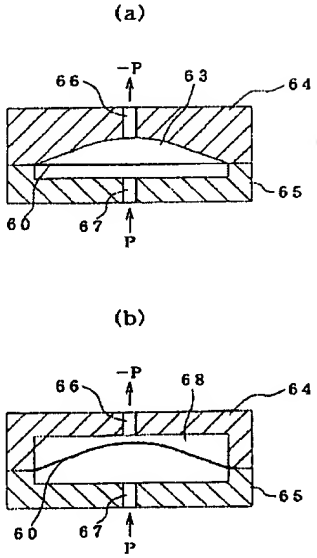

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CLAIMS

[Claim(s)]
[Claim 1] The film valve which consists of the elastic support section which it is formed in the elastic thin film following the differential pressure of the upstream and the downstream, and the front face of this, it is formed in the valve element section which has a through-hole and this valve element section, and one, and is always energized to the upstream, It is arranged at the downstream of the valve seat which is located in the upstream of said ink passage and **** to said through-hole, and this valve seat. The valve gear of the ink feeder current way of the ink jet type recording device which consists of a passage formation plate which forms the passage where the edge side serves as the upper part by making the extended direction of said elastic support section into a long side, and the cross-sectional area becomes narrow.
[Claim 2] The valve gear of the ink feeder current way of the ink jet type recording device according to claim 1 with which said film valve is constituted as a layered product of a plate with a modulus of elasticity smaller than a high polymer film and this high polymer film.
[Claim 3] The valve gear of the ink feeder current way of the ink jet type recording device according to claim 1 currently formed so that said elastic support section may support said valve element section from both sides.
[Claim 4] The valve gear of the ink feeder current way of the ink jet type recording device according to claim 1 currently formed so that said elastic support section may support said valve element section from one side.
[Claim 5] The valve gear of the ink feeder current way of the ink jet type recording device according to claim 3 with which said elastic support section is orthopedically operated by the radial so that said through-hole may be made into the point of symmetry from said valve element section.
[Claim 6] The valve gear of the ink feeder current way of the ink jet type recording device according to claim 1 by which plastic deformation processing is carried out at the convex type configuration where said elastic thin film makes said through-hole top-most vertices.
[Claim 7] The valve gear of the ink feeder current way of an ink jet type recording device according to claim 6 whose swelling of said convex type configuration is extent to which said valve element section deserts said valve seat at least.
[Claim 8] The valve gear of the ink feeder current way of an ink jet type recording device according to claim 6 said whose elastic thin film is a ductility giant molecule.
[Claim 9] The valve gear of the ink feeder current way of the ink jet type recording device according to claim 6 which the duplication field of said elastic thin film and said valve element section has pasted up.
[Claim 10] The container equipped with the ink feed hopper which equipped the upper part with the ink room and by which the ink supply needle of an ink jet type recording head is inserted in the lower part, The elastic thin film following [are stretched so that said ink room and said ink feed hopper may be divided and] the differential pressure of the upstream and the downstream, The film valve which consists of the elastic support section which it is formed on the surface of this, it is formed in the valve element section which has a through-hole and this valve element section, and one, and is always energized to the upstream, The ink cartridge which consists of a passage formation plate which forms the passage where it is arranged at the downstream of the valve seat which is located in the upstream of said ink passage and **** to said through-hole,

and this valve seat, and the edge side serves as the upper part by making the extended direction of said elastic support section into a long side, and the cross-sectional area becomes narrow.
[Claim 11] The ink cartridge according to claim 10 which said film valve consists of as a layered product of a plate with an elastic modulus smaller than a high polymer film and this high polymer film.
[Claim 12] The ink cartridge according to claim 10 currently formed so that said elastic support section may support said valve element section from both sides.
[Claim 13] The ink cartridge according to claim 10 currently formed so that said elastic support section may support said valve element section from one side.
[Claim 14] The ink cartridge according to claim 10 currently formed in the radial so that said through-hole may be made into the point of symmetry from said valve element section.
[Claim 15] The ink cartridge according to claim 10 by which plastic deformation processing is carried out at the convex type configuration where said elastic thin film makes said through-hole top-most vertices.
[Claim 16] The ink cartridge according to claim 15 whose swelling of said convex type configuration is extent to which said valve element section deserts said valve seat at least.
[Claim 17] The ink cartridge according to claim 15 said whose elastic thin film is a ductility giant molecule.
[Claim 18] The ink cartridge according to claim 15 which the duplication field of said elastic thin film and said valve element section has pasted up.
[Claim 19] In the ink supply needle which is open for free passage to the ink passage of an ink jet type recording head, and supplies the ink of an ink cartridge to said recording head The elastic thin film following [are stretched so that the upstream and the downstream of said ink supply needle may be divided, and] the differential pressure of the upstream and the downstream, the film valve which consists of the valve element section which is formed on the surface of this and has a through-hole, and the elastic support section which it is formed in this valve element section and one, and is always energized to the upstream, and the valve seat which is located in the upstream of said ink passage and **** to said through-hole -- since -- the becoming ink supply needle.
[Claim 20] The ink supply needle according to claim 19 with which the passage formation plate which forms the passage where the edge side serves as the upper part by making the extended direction of said elastic support section into a long side, and the cross section becomes narrow at the downstream of this valve seat is arranged.
[Claim 21] The ink supply needle according to claim 19 with which said film valve is constituted as a layered product of a plate with an elastic modulus smaller than a high polymer film and this high polymer film.
[Claim 22] The ink supply needle according to claim 19 currently formed so that said elastic support section may support said valve element section from one side.
[Claim 23] The ink supply needle according to claim 19 by which plastic deformation processing is carried out at the convex type configuration where said elastic thin film makes said through-hole top-most vertices.
[Claim 24] The ink supply needle according to claim 23 whose swelling of said convex type configuration is extent to which said valve element section deserts said valve seat at least.
[Claim 25] The ink supply needle according to claim 23 said whose elastic thin film is a ductility macromolecule.
[Claim 26] The ink supply needle according to claim 23 which the duplication field of said

elastic thin film and said valve element section has pasted up.
[Claim 27] The manufacture approach of the valve gear which consists of the process which forms the elastic support which an end follows at said valve element section, a process which forms a lobe centering on the film of the polymeric materials which can be deformed plastically, and a process which joins two members which consisted of above-mentioned processes so that the through-hole located in the central point with the valve element section at the core at the plate which has elasticity, and a core may be made into a point-symmetry point.
[Claim 28] The manufacture approach of a valve gear according to claim 27 that said lobe is pressurized mechanically and formed.
[Claim 29] The manufacture approach of a valve gear according to claim 27 that said lobe is pressurized in fluid and **** formation is carried out.
[Claim 30] The manufacture approach of a valve gear according to claim 27 that the amount of protrusions of said lobe is extent to which the valve element section deserts a valve seat at least.
[Claim 31] The manufacture approach of a valve gear according to claim 27 that said high polymer film is heated by temperature lower than softening temperature heat deflection temperature or more than second order transition temperature.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[The field of the technique in which invention belongs] This invention relates to the valve gear equipped with the negative pressure generating function arranged on the ink feeder current way which connects an ink jet type recording head and an ink tank.
[0002]
[Description of the Prior Art] An ink jet printer carries at carriage the ink cartridge which supplies ink in the ink jet type recording head which a pressure is impressed [recording head] to the pressure generating room which is open for free passage to a common ink room and a common nozzle orifice, and makes an ink droplet breathe out from a nozzle orifice, and a recording head, and making carriage reciprocate, it is made in agreement with print data, and it is constituted so that a record form may be made to breathe out an ink droplet.
[0003] Since such a recording head is arranged so that the nozzle orifice may usually become lower than the liquid ink side of an ink cartridge, a head acts on a nozzle orifice and it has the problem that leakage **** of ink arises from a nozzle orifice. In order to solve this problem, a porous body is usually held in an ink cartridge, and it is constituted so that the pressure of the ink of an ink cartridge may become low a little rather than a recording head according to the capillary tube force by the porous body.
[0004] However, when the amount of the ink which consumption of ink progresses and is absorbed by the porous body decreases, it originates in the capillary tube force of a porous body, and stagnation arises in supply of the ink to a recording head, the ink of the real volume integral [the problem that the ink in a cartridge cannot be consumed completely, and] of a porous body which can be held in a cartridge decreases, and there is a problem of an ink cartridge being enlarged.
[0005] When the wall which equipped the lower part of an ink tank with the through-hole separates into an ink reservoir and a cavity so that JP,62-231759,A may see, an AMBURERA check valve is prepared in this through-hole and ink ** of a recording head falls in order to solve

such a problem for example, the ink cartridge for ink jet recording heads constituted so that a bulb might be made to open, a cavity might be made to discharge the ink of an ink reservoir and a recording head might be supplied is proposed.
[0006] According to this, since a porous body becomes unnecessary, it becomes possible to make the capacity of ink increase, but generally an AMBURERA check valve has the big problem of the amount of offset being too large, and causing big fluctuation to differential pressure with the ink amount of supply or a recording head, and causing deterioration of a quality of printed character for adjusting supply of the ink to a recording head to a precision. The ink cartridge which can supply ink to compensate for the ink consumption by the recording head is proposed the film valve seat which consists of an elastic thin film equipped with the through-hole separating into an ink inflow and ink outflow side, and making negative pressure maintain ink ** of an ink jet type recording head by some between an ink inflow side and an ink outflow side so that JP,8-174860,A may see, in order to solve such a problem.
[0007]
[Problem(s) to be Solved by the Invention] What [can supply ink, making it correspond to consumption of the ink in a recording head by the film valve seat of a large area, and making a recording head maintain a negative pressure condition according to this] In order to recover expulsion-of-an-ink-droplet capacity, when it makes negative pressure act on a recording head and ink is made to discharge compulsorily from a recording head, since the area of a film valve seat is large, the rate of flow here is low, and exclusion of air bubbles is holding un-arranging [that it is difficult].
[0008] The place which this invention is made in view of such a problem, and is made into the purpose is offering the valve gear in the ink supply way of the ink jet type recording device which can eliminate the air bubbles near the film valve seat outside certainly, maintaining the negative pressure which certainly followed the minute differential pressure between recording heads, and was suitable for the recording head at printing. The 2nd purpose of this invention is offering the ink cartridge which built in the above-mentioned valve gear, and an ink supply needle. Other purposes of this invention are proposing the manufacture approach of the above-mentioned valve gear.
[0009]
[Means for Solving the Problem] In order to solve such a problem, it sets to this invention. The film valve which consists of the elastic support section which it is formed in the elastic thin film following the differential pressure of the upstream and the downstream, and the front face of this, it is formed in the valve element section which has a through-hole and this valve element section, and one, and is always energized to the upstream, It had the passage formation plate which forms the passage where it is arranged at the downstream of the valve seat which is located in the upstream of said ink passage and **** to said through-hole, and this valve seat, and the edge side serves as the upper part by making the extended direction of said elastic support section into a long side, and the cross section becomes narrow.
[0010]
[Function] A film valve opens passage in response to differential pressure corresponding to consumption of the ink in a recording head in a large area, and supplies ink to a recording head. Moreover, the lower field of a film valve makes an edge side the upper part with a passage formation plate, and since it is formed so that it may become narrow, air bubbles focus here, and also when negative pressure is made to act on a recording head and ink is discharged compulsorily, the ink rate of flow here does not fall unnecessarily, therefore air bubbles ride in

the style of ink, and it is discharged outside.
[0011]
[Embodiment of the Invention] Then, based on the example illustrating the detail of this invention, it explains below. The container 1 which drawing 1 shows one example of the ink cartridge into which the valve gear of this invention was built, and constitutes an ink cartridge body forms the ink feed hopper 5 which has the ink room 2 in the upper part and by which the ink supply needle N of a recording head is inserted in a base 4, and is constituted.
[0012] Between the ink room 2 and the ink feed hopper 5, the abbreviation rectangle-like crevice is formed so that the film valve 6 which separates these can be held. A film valve 6 is supported by level difference section 1a of a container 1 in the perimeter of the inferior surface of tongue, fixes an ink room side by the valve seat formation member 7, and is included in the container 1.
[0013] More than one are drilled so that, as for the valve seat formation member 7, at least one through-hole 9 which heights 7a which projects in the downstream is formed in a core, and the valve seat 8 which consists of elastic members, such as rubber, at the tip is fixed, and is open for free passage on the outskirts at the ink room 2 may make heights 7a the point of symmetry preferably.
[0014] The ink style regulation plate 10 which makes a valve seat 8 the bottom in the lower part field of a film valve 6, and makes both sides an ink room side is arranged. The through-holes 11 and 11 which are open for free passage to the ink feed hopper 5 are drilled in the highest location which the ink style regulation plate 10 occupies.
[0015] As shown in drawing 3 (a) and (b), the film valve seat 6 The flexible high polymer film 12, 4 side 14, and 15, 16 and 17 which start a layered product with a metal plate 13 in a rectangle, and become a support field by the ink container 1 and the valve seat formation member 7, While etching a metal plate 13 and forming the outcrops 20 and 20 of a high polymer film 12 from an aperture so that it may leave the long and slender elastic support sections 19 and 19 which support the core used as the valve element section 18, and the valve element section 18 from both sides, and are prolonged in a long side side The through-hole 21 which circulates ink is drilled in the valve element section 18, and it is constituted.
[0016] The width of face is chosen so that the elastic support sections 19 and 19 may have the elasticity which can carry out elastic deformation when bigger differential pressure a little than the negative pressure of extent which can maintain the meniscus of a recording head acts.
[0017] The film valve seat 6 is in the condition set to level difference section 1a of a container 1, it fixes by the valve seat formation member 7 from an ink room side, and is fixed to a container 1 in the state of fluid-tight, and the air bubbles contained in ink in the upper part if needed and the filter 22 from which dust is removed are arranged.
[0018] In this example, the ink feed hopper 5 of an ink cartridge is inserted in the ink supply needle N of a recording head, and is set in a recording device. A possibility of causing un-arranging is in printing after atmospheric air infiltrates into an ink cartridge or a recording head by insertion of the ink supply needle N.
[0019] The pressure of the ink feed hopper 5 declines, differential pressure acts on a film valve 6, and if negative pressure is made to act on a recording head through a cap member and the ink of an ink cartridge is absorbed to a recording head in order to avoid such un-arranging, as shown in drawing 2 (a) and (b), a film valve 6 will separate from a valve seat 8, and the ink of the ink room 2 will pass the through-hole 11 of the highest location of the lower part of a film valve 6, and will flow to the ink feed hopper 5.
[0020] On the other hand, the air bubbles for which film valves 6 have gathered caudad with it

since, as for the lower part field of a film valve 6, the passage where the direction of a long side of a film valve 6 approached the film valve side, and the cross direction was extracted for the edge is formed of the ink passage regulation plate 10 gather near the through-hole 11 by own buoyancy. And since it is quick as compared with the field of others [rate of flow / of ink here], air bubbles are put in the style of ink, and it is discharged by the cap member via a recording head.

[0021] In the phase which restoration of ink ended, if printing is performed, the ink of the lower field of the film valve seat 6 will flow into a recording head from the ink feed hopper 5, and the pressure of the lower field of a film valve 6 will decline gradually. If a pressure drop becomes larger than the bearing capacity of the elastic support section 19, a film valve 6 will bend in the ink feed hopper 5 side, and a through-hole 21 will separate from a valve seat 8. By the time this results in negative pressure with too much pressure of the ink feed hopper 5, the ink of the ink room 2 will flow into the ink feed hopper 5 through a through-hole 21.

[0022] If the pressure of the lower field of a film valve 6 rises a little by the inflow of ink, will guide the elastic support section 19 certainly, will move it to the upstream, without being influenced of rocking of a high polymer film 12 etc., it will be made to **** the valve element section 18 to a valve seat 8 by overcoming the pressure of the ink from the upper part, and will plug up a through-hole 21. Thereby, the outflow of the ink from the ink room 2 stops. Therefore, there is no **** in the height of the liquid ink side of the ink room 3, and it is maintained by the negative pressure suitable for the pressure of the ink feed hopper 5 maintaining the meniscus of a recording head.

[0023] If the nozzle plate of a recording head is closed with a capping means and negative pressure is made to act when un-arranging arises in the regurgitation of the ink droplet from a nozzle orifice by printing of long duration, the air bubbles which have gathered near the through-hole 11 will be discharged besides a recording head by the same operation as the time of restoration actuation of the above-mentioned ink.

[0024] What drawing 4 thru/or drawing 6 show other examples of a film valve 6, respectively, and was shown in drawing 4 is what formed the branches 23 and 23 arranged so that the through-hole 21 of the valve element section 18 may be made into a point symmetry point by etching of a metal plate 13 etc., can transmit differential pressure to the valve element section 18 and the elastic support section 19 certainly, and can prevent too much deformation of a high polymer film 12.

[0025] Drawing 5 etches a metal plate 13 and forms the aperture of a rhombus so that one example of the optimal film valve may be shown when the passage of the lower field of a film valve 6 is extracted with the ink passage regulation plate 10 as becoming so thin that it going to the edge of the extended direction of the elastic support section 19, and it may attach on the outskirts with the valve element section 18 of a core, and the elastic support section 19 which supports this from both sides and it may leave the frame parts 25, 26, 27, and 28 of business.

[0026] According to this example, the rigidity of the high polymer film 12 of the central field in which the valve element section 18 is located can be weakened, and the valve element section 18 can be made to follow differential pressure easily. Moreover, passage of the fixed part field of the elastic support section 19 used as the topmost part where air bubbles tend to stagnate can be narrowed, and air bubbles can be easily eliminated by the flow of the ink which flowed in from the through-hole 9.

[0027] The valve element section 18 was made to support by 19', and elastic support section 19' which formed the elastic support sections 19 and 19 in the shape of zigzag, and according to this

example, drawing 6 can expand the deflection deformation field of elastic support section 19' and 19', and can make the valve element section 20 follow also to minute differential pressure.
[0028] Drawing 7 (a) and (b) show other examples of this invention, and it is constituted and they get down from a film valve 6 so that only the 1 side of the valve element section 18 may be made to support in the shape of a cantilever by the elastic support section 29 as shown in drawing 8 . Moreover, the passage formation substrate 30 inclines up so that it may meet in the extended direction of the cantilever-like elastic support section 29, and it is constituted so that ink may be made to flow into the ink feed hopper 5 out of one through-hole 31 prepared in the highest location, while regulating the passage of the lower part of a film valve 6 so that width of face may become narrow.
[0029] Since it is possible to regulate narrowly the field of the ink passage near the film valve 6 as much as possible according to this example, the air bubbles of a film valve 6 can be brought together in one place, and it can discharge outside by ink flow.
[0030] Drawing 9 shows one example of the film valve suitable for a valve gear same as the above, and it operates a metal plate orthopedically by etching etc. so that it may leave the valve element section 18, and the elastic support section 29 and a frame part 32 and the aperture 33 of a waterdrop mold may be formed.
[0031] In addition, when a valve gear was built into an ink cartridge in an above-mentioned example, the example was taken and explained, but although the mentioning [above]-to connection field of ink supply way [of a recording head] P and ink tank valve gear 40 is incorporated to the recording head of the disposer bull type which unified the recording head and the ink tank as shown in drawing 10 , it is clear to do the same operation so.
[0032] Drawing 11 (a) and (b) show other examples of this invention, respectively, incorporated the valve gear 40 mentioned above in the connection of the ink supply way which is open for free passage to recording head H in this example, and the ink supply needle N which this is made open for free passage and installed, and form filters 41 and 42 in the downstream of a valve gear 40, and the upstream.
[0033] In addition, when the valve seat section was supported from both sides in this example, the example was taken and explained, but if the valve gear which supported the valve portion shown in drawing 7 in the shape of a cantilever is incorporated, since the elastic support section can be shortened, inclusion is easy.
[0034] Moreover, although the layered product of a high polymer film and a metal plate is processed by etching in an above-mentioned example, the same operation is done so, even if press working of sheet metal of a metal plate constitutes the valve element section, the elastic support section, and a frame part and it sticks on a high polymer film the macromolecule plate constituted with injection molding of a macromolecule.
[0035] by the way, making elasticity of the whole film valve small as much as possible, since the differential pressure which acts on a film valve is low, if it is in print data with comparatively low dot density -- ** -- the location of the valve element section becomes better and unstable, a fall is caused to ink serviceability, and the engine performance falls on the contrary.
[0036] Drawing 12 (a) shows one example of the film valve suitable for solving such a problem, and has elasticity. Processing the easy metal plate 50, for example, stainless steel with a thickness of about 0.03mm, to the central point The valve element section 52, The through-hole 53 located at the core, and the branches 54 and 54 of the shape of zigzag by which an end follows the valve element section 52 so that a core may be made into a point symmetry point, The periphery section 55 linked to the other end of branches 54 and 54 Etching processing and

the thing which carried out press working of sheet metal, The ductility polymeric materials 51 which can be deformed plastically, for example, a polyphenylene sulfide (PPS) resin film with a thickness of 0.0035mm, drawing 12 (b), Desirably, in the valve element section 52, it joins through a glue line or an adhesive layer, and what carried out plastic deformation beforehand so that a core might project to extent to which the valve element section 52 deserts a valve seat 8 at least as shown in (c) is constituted. In addition, after junction or before junction, a through-hole is drilled in the location corresponding to the through-hole 53 of the valve element section 52 to the resin film 51, and passage is formed.

[0037] Such plastic deformation processing can be positioned to the convex type material 61 of the swelling configuration considered as a request, as were shown in drawing 13 (I), and it heats beforehand to temperature lower than softening temperature and was shown in drawing 13 (I) the heat deflection temperature of the resin film 60, or more than second order transition temperature, and subsequently it can give a swelling to drawing 13 (II) by pressing by the concave material 62 which corresponds as shown.

[0038] According to this example, since the swelling equivalent to a valve-opening condition is attached to the resin film 51, as for the contact force to the valve seat 8 of the valve element section 52, only the elasticity of branches 54 and 54 will act substantially. Consequently, it can be made to open by small differential pressure, raising the rigidity of branches 54 and 54 and preventing wandering of the valve element section 52.

[0039] And if the resin film 51 and the valve element section 52 limit especially a junction field to the field which carries out a lap, the resin film 51 can control the elastic force which acts on the valve element section 52, and can raise the flattery nature of the valve element section 52.

[0040] The example which shows other examples of above-mentioned plastic deformation processing, and was shown in drawing 14 (a) sets drawing 14 (a) and (b). Fixing the periphery of the resin film 60 in airtight according to the cap member 64 in which the crevice 63 required for plastic working was formed, and a pedestal 65, and heating below to softening temperature heat deflection temperature or more than second order transition temperature Negative pressure-P is made for a through-hole 66 and 67 differential pressure to act on grant 63, i.e., a crevice, and a pressure P is applied from a pedestal side, and plastic deformation is carried out so that the pressure by the side of a crevice 63 may become high.

[0041] In addition, although the crevice 63 corresponding to the configuration which should carry out plastic deformation to the cap member 64 in an above-mentioned example is formed, as shown in drawing 14 (b), it forms as a mere cavity 68, and even if it gives differential pressure to the resin film 60 like the above-mentioned, plastic deformation can be carried out similarly.

[0042] In addition, it is clear effective to perform plastic deformation processing to a high polymer film also to the example shown in drawing 3 , drawing 4 , drawing 5 , drawing 6 , drawing 8 , and drawing 9 in this way.

[0043]

[Effect of the Invention] As mentioned above, the film valve which consists of the elastic support section which it is formed in the elastic thin film following the differential pressure of the upstream and the downstream, and the front face of this in this invention as explained, and it is formed in the valve element section which has a through-hole and the valve element section, and one, and is always energized to the upstream, Since it had with the passage formation plate which forms the passage where it is arranged at the downstream of the valve seat which is located in the upstream of ink passage and **** to a through-hole, and a valve seat, and the edge side serves as the upper part by making the extended direction of the elastic support section into

a long side, and the cross section becomes narrow A film valve opens passage in response to differential pressure corresponding to consumption of the ink in a recording head in a large area, and can supply ink to a recording head. Moreover, the lower field of a film valve makes an edge side the upper part with a passage formation plate, and it is formed so that it may become narrow, and air bubbles can be centralized here, and it can put on the flow of the ink discharged compulsorily, and air bubbles can be discharged certainly outside.
[0044] Moreover, as compared with the case where a film valve is constituted from a thin film independent, with the rigidity of an elastic support member, maintenance of the center position of a film valve and fluctuation of the elastic modulus in ink can be prevented that there is no **** in vibration of carriage etc., a switching action can be stabilized, and the dependability of the ink supply to a recording head can be secured.

TECHNICAL FIELD

[The field of the technique in which invention belongs] This invention relates to the valve gear equipped with the negative pressure generating function arranged on the ink feeder current way which connects an ink jet type recording head and an ink tank.

PRIOR ART

[Description of the Prior Art] An ink jet printer carries at carriage the ink cartridge which supplies ink in the ink jet type recording head which a pressure is impressed [recording head] to the pressure generating room which is open for free passage to a common ink room and a common nozzle orifice, and makes an ink droplet breathe out from a nozzle orifice, and a recording head, and making carriage reciprocate, it is made in agreement with print data, and it is constituted so that a record form may be made to breathe out an ink droplet.
[0003] Since such a recording head is arranged so that the nozzle orifice may usually become lower than the liquid ink side of an ink cartridge, a head acts on a nozzle orifice and it has the problem that leakage **** of ink arises from a nozzle orifice. In order to solve this problem, a porous body is usually held in an ink cartridge, and it is constituted so that the pressure of the ink of an ink cartridge may become low a little rather than a recording head according to the capillary tube force by the porous body.
[0004] However, when the amount of the ink which consumption of ink progresses and is absorbed by the porous body decreases, it originates in the capillary tube force of a porous body, and stagnation arises in supply of the ink to a recording head, the ink of the real volume integral [the problem that the ink in a cartridge cannot be consumed completely, and] of a porous body which can be held in a cartridge decreases, and there is a problem of an ink cartridge being enlarged.
[0005] When the wall which equipped the lower part of an ink tank with the through-hole separates into an ink reservoir and a cavity so that JP,62-231759,A may see, an AMBURERA check valve is prepared in this through-hole and ink ** of a recording head falls in order to solve such a problem for example, the ink cartridge for ink jet recording heads constituted so that a bulb might be made to open, a cavity might be made to discharge the ink of an ink reservoir and a recording head might be supplied is proposed.
[0006] According to this, since a porous body becomes unnecessary, it becomes possible to make the capacity of ink increase, but generally an AMBURERA check valve has the big problem of

the amount of offset being too large, and causing big fluctuation to differential pressure with the ink amount of supply or a recording head, and causing deterioration of a quality of printed character for adjusting supply of the ink to a recording head to a precision. The ink cartridge which can supply ink to compensate for the ink consumption by the recording head is proposed the film valve seat which consists of an elastic thin film equipped with the through-hole separating into an ink inflow and ink outflow side, and making negative pressure maintain ink ** of an ink jet type recording head by some between an ink inflow side and an ink outflow side so that JP,8-174860,A may see, in order to solve such a problem.

EFFECT OF THE INVENTION

[Effect of the Invention] As mentioned above, the film valve which consists of the elastic support section which it is formed in the elastic thin film following the differential pressure of the upstream and the downstream, and the front face of this in this invention as explained, and it is formed in the valve element section which has a through-hole and the valve element section, and one, and is always energized to the upstream, It had with the passage formation plate which forms the passage where it is arranged at the downstream of the valve seat which is located in the upstream of ink passage and **** to a through-hole, and a valve seat, and the edge side serves as the upper part by making the extended direction of the elastic support section into a long side, and the cross section becomes narrow. Therefore, it can put on the flow of the ink which is formed so that passage may be opened in response to differential pressure corresponding to consumption of the ink in a recording head in area with a large film valve, and ink can be supplied to a recording head and it may become narrow [that the lower field of a film valve makes an edge side the upper part with a passage formation plate], and is discharged compulsorily [centralizing air bubbles here], and air bubbles can be discharged certainly outside.

[0044] Moreover, as compared with the case where a film valve is constituted from a thin film independent, with the rigidity of an elastic support member, maintenance of the center position of a film valve and fluctuation of the elastic modulus in ink can be prevented that there is no **** in vibration of carriage etc., a switching action can be stabilized, and the dependability of the ink supply to a recording head can be secured.

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] What [can supply ink, making it correspond to consumption of the ink in a recording head by the film valve seat of a large area, and making a recording head maintain a negative pressure condition according to this] In order to recover expulsion-of-an-ink-droplet capacity, when it makes negative pressure act on a recording head and ink is made to discharge compulsorily from a recording head, since the area of a film valve seat is large, the rate of flow here is low, and exclusion of air bubbles is holding un-arranging [that it is difficult].

[0008] The place which this invention is made in view of such a problem, and is made into the purpose is offering the valve gear in the ink supply way of the ink jet type recording device which can eliminate the air bubbles near the film valve seat outside certainly, maintaining the negative pressure which certainly followed the minute differential pressure between recording heads, and was suitable for the recording head at printing. The 2nd purpose of this invention is

offering the ink cartridge which built in the above-mentioned valve gear, and an ink supply needle. Other purposes of this invention are proposing the manufacture approach of the above-mentioned valve gear.

MEANS

[Means for Solving the Problem] In order to solve such a problem, it sets to this invention. The film valve which consists of the elastic support section which it is formed in the elastic thin film following the differential pressure of the upstream and the downstream, and the front face of this, it is formed in the valve element section which has a through-hole and this valve element section, and one, and is always energized to the upstream, It had the passage formation plate which forms the passage where it is arranged at the downstream of the valve seat which is located in the upstream of said ink passage and **** to said through-hole, and this valve seat, and the edge side serves as the upper part by making the extended direction of said elastic support section into a long side, and the cross section becomes narrow.

OPERATION

[Function] A film valve opens passage in response to differential pressure corresponding to consumption of the ink in a recording head in a large area, and supplies ink to a recording head. Moreover, the lower field of a film valve makes an edge side the upper part with a passage formation plate, and since it is formed so that it may become narrow, air bubbles focus here, and also when negative pressure is made to act on a recording head and ink is discharged compulsorily, the ink rate of flow here does not fall unnecessarily, therefore air bubbles ride in the style of ink, and it is discharged outside.

[0011]

[Embodiment of the Invention] Then, based on the example illustrating the detail of this invention, it explains below. The container 1 which drawing 1 shows one example of the ink cartridge into which the valve gear of this invention was built, and constitutes an ink cartridge body forms the ink feed hopper 5 which has the ink room 2 in the upper part and by which the ink supply needle N of a recording head is inserted in a base 4, and is constituted.

[0012] Between the ink room 2 and the ink feed hopper 5, the abbreviation rectangle-like crevice is formed so that the film valve 6 which separates these can be held. A film valve 6 is supported by level difference section 1a of a container 1 in the perimeter of the inferior surface of tongue, fixes an ink room side by the valve seat formation member 7, and is included in the container 1.

[0013] More than one are drilled so that, as for the valve seat formation member 7, at least one through-hole 9 which heights 7a which projects in the downstream is formed in a core, and the valve seat 8 which consists of elastic members, such as rubber, at the tip is fixed, and is open for free passage on the outskirts at the ink room 2 may make heights 7a the point of symmetry preferably.

[0014] The ink style regulation plate 10 which makes a valve seat 8 the bottom in the lower part field of a film valve 6, and makes both sides an ink room side is arranged. The through-holes 11 and 11 which are open for free passage to the ink feed hopper 5 are drilled in the highest location which the ink style regulation plate 10 occupies.

[0015] As shown in drawing 3 (a) and (b), the film valve seat 6 The flexible high polymer film 12, 4 side 14, and 15, 16 and 17 which start a layered product with a metal plate 13 in a

rectangle, and become a support field by the ink container 1 and the valve seat formation member 7, While etching a metal plate 13 and forming the outcrops 20 and 20 of a high polymer film 12 from an aperture so that it may leave the long and slender elastic support sections 19 and 19 which support the core used as the valve element section 18, and the valve element section 18 from both sides, and are prolonged in a long side side The through-hole 21 which circulates ink is drilled in the valve element section 18, and it is constituted.

[0016] The width of face is chosen so that the elastic support sections 19 and 19 may have the elasticity which can carry out elastic deformation when bigger differential pressure a little than the negative pressure of extent which can maintain the meniscus of a recording head acts.

[0017] The film valve seat 6 is in the condition set to level difference section 1a of a container 1, it fixes by the valve seat formation member 7 from an ink room side, and is fixed to a container 1 in the state of fluid-tight, and the air bubbles contained in ink in the upper part if needed and the filter 22 from which dust is removed are arranged.

[0018] In this example, the ink feed hopper 5 of an ink cartridge is inserted in the ink supply needle N of a recording head, and is set in a recording device. A possibility of causing un-arranging is in printing after atmospheric air infiltrates into an ink cartridge or a recording head by insertion of the ink supply needle N.

[0019] The pressure of the ink feed hopper 5 declines, differential pressure acts on a film valve 6, and if negative pressure is made to act on a recording head through a cap member and the ink of an ink cartridge is absorbed to a recording head in order to avoid such un-arranging, as shown in drawing 2 (a) and (b), a film valve 6 will separate from a valve seat 8, and the ink of the ink room 2 will pass the through-hole 11 of the highest location of the lower part of a film valve 6, and will flow to the ink feed hopper 5.

[0020] On the other hand, the air bubbles for which film valves 6 have gathered caudad with it since, as for the lower part field of a film valve 6, the passage where the direction of a long side of a film valve 6 approached the film valve side, and the cross direction was extracted for the edge is formed of the ink passage regulation plate 10 gather near the through-hole 11 by own buoyancy. And since it is quick as compared with the field of others [rate of flow / of ink here], air bubbles are put in the style of ink, and it is discharged by the cap member via a recording head.

[0021] In the phase which restoration of ink ended, if printing is performed, the ink of the lower field of the film valve seat 6 will flow into a recording head from the ink feed hopper 5, and the pressure of the lower field of a film valve 6 will decline gradually. If a pressure drop becomes larger than the bearing capacity of the elastic support section 19, a film valve 6 will bend in the ink feed hopper 5 side, and a through-hole 21 will separate from a valve seat 8. By the time this results in negative pressure with too much pressure of the ink feed hopper 5, the ink of the ink room 2 will flow into the ink feed hopper 5 through a through-hole 21.

[0022] If the pressure of the lower field of a film valve 6 rises a little by the inflow of ink, will guide the elastic support section 19 certainly, will move it to the upstream, without being influenced of rocking of a high polymer film 12 etc., it will be made to **** the valve element section 18 to a valve seat 8 by overcoming the pressure of the ink from the upper part, and will plug up a through-hole 21. Thereby, the outflow of the ink from the ink room 2 stops. Therefore, there is no **** in the height of the liquid ink side of the ink room 3, and it is maintained by the negative pressure suitable for the pressure of the ink feed hopper 5 maintaining the meniscus of a recording head.

[0023] If the nozzle plate of a recording head is closed with a capping means and negative

pressure is made to act when un-arranging arises in the regurgitation of the ink droplet from a nozzle orifice by printing of long duration, the air bubbles which have gathered near the through-hole 11 will be discharged besides a recording head by the same operation as the time of restoration actuation of the above-mentioned ink.

[0024] What drawing 4 thru/or drawing 6 show other examples of a film valve 6, respectively, and was shown in drawing 4 is what formed the branches 23 and 23 arranged so that the through-hole 21 of the valve element section 18 may be made into a point symmetry point by etching of a metal plate 13 etc., can transmit differential pressure to the valve element section 18 and the elastic support section 19 certainly, and can prevent too much deformation of a high polymer film 12.

[0025] Drawing 5 etches a metal plate 13 and forms the aperture of a rhombus so that one example of the optimal film valve may be shown when the passage of the lower field of a film valve 6 is extracted with the ink passage regulation plate 10 as becoming so thin that it going to the edge of the extended direction of the elastic support section 19, and it may attach on the outskirts with the valve element section 18 of a core, and the elastic support section 19 which supports this from both sides and it may leave the frame parts 25, 26, 27, and 28 of business.

[0026] According to this example, the rigidity of the high polymer film 12 of the central field in which the valve element section 18 is located can be weakened, and the valve element section 18 can be made to follow differential pressure easily. Moreover, passage of the fixed part field of the elastic support section 19 used as the topmost part where air bubbles tend to stagnate can be narrowed, and air bubbles can be easily eliminated by the flow of the ink which flowed in from the through-hole 9.

[0027] The valve element section 18 was made to support by 19', and elastic support section 19' which formed the elastic support sections 19 and 19 in the shape of zigzag, and according to this example, drawing 6 can expand the deflection deformation field of elastic support section 19' and 19', and can make the valve element section 20 follow also to minute differential pressure.

[0028] Drawing 7 (a) and (b) show other examples of this invention, and it is constituted and they get down from a film valve 6 so that only the 1 side of the valve element section 18 may be made to support in the shape of a cantilever by the elastic support section 29 as shown in drawing 8 . Moreover, the passage formation substrate 30 inclines up so that it may meet in the extended direction of the cantilever-like elastic support section 29, and it is constituted so that ink may be made to flow into the ink feed hopper 5 out of one through-hole 31 prepared in the highest location, while regulating the passage of the lower part of a film valve 6 so that width of face may become narrow.

[0029] Since it is possible to regulate narrowly the field of the ink passage near the film valve 6 as much as possible according to this example, the air bubbles of a film valve 6 can be brought together in one place, and it can discharge outside by ink flow.

[0030] Drawing 9 shows one example of the film valve suitable for a valve gear same as the above, and it operates a metal plate orthopedically by etching etc. so that it may leave the valve element section 18, and the elastic support section 29 and a frame part 32 and the aperture 33 of a waterdrop mold may be formed.

[0031] In addition, when a valve gear was built into an ink cartridge in an above-mentioned example, the example was taken and explained, but although the mentioning [above]-to connection field of ink supply way [of a recording head] P and ink tank valve gear 40 is incorporated to the recording head of the disposer bull type which unified the recording head and the ink tank as shown in drawing 10 , it is clear to do the same operation so.

[0032] Drawing 11 (a) and (b) show other examples of this invention, respectively, incorporated the valve gear 40 mentioned above in the connection of the ink supply way which is open for free passage to recording head H in this example, and the ink supply needle N which this is made open for free passage and installed, and form filters 41 and 42 in the downstream of a valve gear 40, and the upstream.
[0033] In addition, when the valve seat section was supported from both sides in this example, the example was taken and explained, but if the valve gear which supported the valve portion shown in drawing 7 in the shape of a cantilever is incorporated, since the elastic support section can be shortened, inclusion is easy.
[0034] Moreover, although the layered product of a high polymer film and a metal plate is processed by etching in an above-mentioned example, the same operation is done so, even if press working of sheet metal of a metal plate constitutes the valve element section, the elastic support section, and a frame part and it sticks on a high polymer film the macromolecule plate constituted with injection molding of a macromolecule.
[0035] by the way, making elasticity of the whole film valve small as much as possible, since the differential pressure which acts on a film valve is low, if it is in print data with comparatively low dot density -- ** -- the location of the valve element section becomes better and unstable, a fall is caused to ink serviceability, and the engine performance falls on the contrary.
[0036] Drawing 12 (a) shows one example of the film valve suitable for solving such a problem, and has elasticity. Processing the easy metal plate 50, for example, stainless steel with a thickness of about 0.03mm, to the central point The valve element section 52, The through-hole 53 located at the core, and the branches 54 and 54 of the shape of zigzag by which an end follows the valve element section 52 so that a core may be made into a point symmetry point, The periphery section 55 linked to the other end of branches 54 and 54 Etching processing and the thing which carried out press working of sheet metal, The ductility polymeric materials 51 which can be deformed plastically, for example, a polyphenylene sulfide (PPS) resin film with a thickness of 0.0035mm, drawing 12 (b), Desirably, in the valve element section 52, it joins through a glue line or an adhesive layer, and what carried out plastic deformation beforehand so that a core might project to extent to which the valve element section 52 deserts a valve seat 8 at least as shown in (c) is constituted. In addition, after junction or before junction, a through-hole is drilled in the location corresponding to the through-hole 53 of the valve element section 52 to the resin film 51, and passage is formed.
[0037] Such plastic deformation processing can be positioned to the convex type material 61 of the swelling configuration considered as a request, as were shown in drawing 13 (I), and it heats beforehand to temperature lower than softening temperature and was shown in drawing 13 (I) the heat deflection temperature of the resin film 60, or more than second order transition temperature, and subsequently it can give a swelling to drawing 13 (II) by pressing by the concave material 62 which corresponds as shown.
[0038] According to this example, since the swelling equivalent to a valve-opening condition is attached to the resin film 51, as for the contact force to the valve seat 8 of the valve element section 52, only the elasticity of branches 54 and 54 will act substantially. Consequently, it can be made to open by small differential pressure, raising the rigidity of branches 54 and 54 and preventing wandering of the valve element section 52.
[0039] And if the resin film 51 and the valve element section 52 limit especially a junction field to the field which carries out a lap, the resin film 51 can control the elastic force which acts on the valve element section 52, and can raise the flattery nature of the valve element section 52.

[0040] The example which shows other examples of above-mentioned plastic deformation processing, and was shown in drawing 14 (a) sets drawing 14 (a) and (b). Fixing the periphery of the resin film 60 in airtight according to the cap member 64 in which the crevice 63 required for plastic working was formed, and a pedestal 65, and heating below to softening temperature heat deflection temperature or more than second order transition temperature Negative pressure-P is made for a through-hole 66 and 67 differential pressure to act on grant 63, i.e., a crevice, and a pressure P is applied from a pedestal side, and plastic deformation is carried out so that the pressure by the side of a crevice 63 may become high.
[0041] In addition, although the crevice 63 corresponding to the configuration which should carry out plastic deformation to the cap member 64 in an above-mentioned example is formed, as shown in drawing 14 (b), it forms as a mere cavity 68, and even if it gives differential pressure to the resin film 60 like the above-mentioned, plastic deformation can be carried out similarly.
[0042] In addition, it is clear effective to perform plastic deformation processing to a high polymer film also to the example shown in drawing 3 , drawing 4 , drawing 5 , drawing 6 , drawing 8 , and drawing 9 in this way.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] Drawing (a) and (b) are drawings showing the cross-section structure of the direction of a long side of a valve gear, and the direction of a shorter side for one example of the ink cartridge of this invention in the state of clausilium, respectively.
[Drawing 2] Drawing (a) and (b) are drawings showing the cross-section structure of the direction of a long side of a valve gear, and the direction of a shorter side for one example of the ink cartridge of this invention in the state of valve opening, respectively.
[Drawing 3] Drawing (a) and (b) are the plan showing one example of the film valve which constitutes a valve gear same as the above, respectively, and the sectional view of the plate used for this.
[Drawing 4] It is the plan showing other examples of the film valve used for the ink cartridge of this invention.
[Drawing 5] It is the plan showing other examples of the film valve used for the ink cartridge of this invention.
[Drawing 6] It is the plan showing other examples of the film valve used for the ink cartridge of this invention.
[Drawing 7] Drawing (a) and (b) are drawings showing the cross-section structure of the direction of a long side of a valve gear, and the direction of a shorter side for other examples of the valve gear of this invention in the state of valve opening.
[Drawing 8] It is the plan showing one example of the film valve of a valve gear same as the above.
[Drawing 9] It is the plan showing other examples of the film valve of a valve gear same as the above.
[Drawing 10] It is the sectional view showing the example which built the valve gear of this invention into the recording head constituted as an ink tank and integral construction.
[Drawing 11] Drawing (a) and (b) are the sectional views showing the example which built the valve gear of this invention into the ink supply needle, respectively.
[Drawing 12] Drawing (a) is a plan showing other examples of the film valve suitable for this

invention, and drawing (b) and (c) are drawings showing the cross-section configuration in an A-A line and a B-B line for the configuration of the resin film which constitutes a film valve, respectively.
[Drawing 13] Drawing (I) and (II) are drawings showing the processing process of a resin film among the production processes of a film valve same as the above, respectively.
[Drawing 14] Drawing (a) and (b) are drawings showing other examples of the manufacture approach of a film valve same as the above.
[Description of Notations]
1 Ink Container
2 Ink Room
5 Ink Feed Hopper
6 Film Valve
7 Valve Seat Formation Member
8 Valve Seat
9 Through-hole
12 High Polymer Film
19 Elastic Support Section
20 Outcrop of High Polymer Film
21 Through-hole
N Ink supply needle
H Ink jet type recording head
P Ink passage

[Translation done.]